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# TRANSLATIONS ON EASTERN EUROPE

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## BULGARIA

### SIGNIFICANCE, ACHIEVEMENTS OF BIOLOGICAL SCIENCES

Sofia SPISANIE NA BULGARSKATA AKADEMIYA NA NAUKITE in Bulgarian No 3, 1977  
pp 41-47

[Article by Academician Kiril Bratanov: "Urgent Problems in Biological Sciences"]

[Text] In January 1977 an expanded annual council of the Center for Science and Personnel Training in Biology and Medicobiological Problems of the Bulgarian Academy of Sciences was held. At this forum a thorough analysis was made, in the light of the decisions of the 11th Party Congress and July Plenum, of the state of the biological sciences in our country and prospects for their development. Special priority was given to the tasks confronting the biological sciences stemming from the Decision of the Political Bureau of the Party Central Committee on the State of the Biological Sciences and Measures for their Accelerated Development. This document indicates that among the conditions for building a developed socialist society and for a modern scientific and technical revolution, the biological sciences are taking on greater significance for the development of productive forces and the solution of such social problems as safeguarding man's health and lengthening the period of his activity, raising the productivity of biological resources and their rational utilization, and protecting the natural environment as a vitally important condition for man's existence and the development of society.

All forecasts of the development of science up to the end of our century foresee the rapid development of biology and its key role in the overall scientific front. The biological sciences, and especially molecular biology, are on the threshold of new discoveries which will revolutionize knowledge of animate matter and the possibilities of its guided development. There is clearly emerging a tendency to tie in biological research directly with problems of social service and material production. The biological sciences will gain even greater significance philosophically as they reveal the essence of living phenomena more and more profoundly.

The development of the biological sciences also has a national significance that stems from their role in studying and making rational use of the country's biological resources and in protecting and strengthening the natural environment.

Therefore, one of the most important tasks today on the biological front is to make use of the great reserves latent in animate nature -- microorganisms, the subject matter of modern industrial microbiology, for the useful synthesis of protein; cultivated plants, the target of intensive plant-growing, for still higher yields; animals, the object of modern industrial animal husbandry, for the production of the animal protein so much needed; forests, the lungs of our planet, for the production of wood pulp and the protection of the surrounding environment.

These branches of animate nature must be the subject of purposeful scientific investigation, and through the application of modern scientific methods science must make even more comprehensive use of the entire genetic charge which animate organisms have for full manifestation of the biological potential of multiplication, growth, development and reproduction. From these four branches of animate nature many of the good things so necessary today can be obtained.

Many important tasks are also set that involve studying the biology of the highest form of animate nature -- man, because essentially everything that is done in our socialist society is for man. That is why the most important questions put to biological science are those involving human health protection and care and especially the problem of man's longevity and the lengthening of his period of creative activity, as well as problems in the control of cancer and cardiovascular diseases, the problem of organ transplants, scientifically grounded nutrition, regulation of population growth etc.

The fundamental task assigned is not only the study of complex biological processes but also their mastery so that they can be regulated and guided, so that animate matter can develop in such a way as to be of benefit to society and the economy. And considering how huge and diverse the research subject matter in the biological sciences is in the complex scale of the animate world from viruses to man, how mighty the biological potential of animate nature is, and how powerful such processes as photosynthesis, heterosis, multiplication, growth, development and, in general, the change of animate matter in its ontogeny and phylogeny are, some with reason say that the last quarter of the 20th century will be a period of still greater flourishing of the biological sciences.

The tasks set for the biological sciences today necessitate the employment of modern methods of scientific research and ever wider use of the experimental methods of biophysics, biochemistry, immunology, enzymology, mathematics and cybernetics in order to delve still more profoundly into animate matter and shed light on a number of processes of great theoretical and applied significance. Clarification of the nature of some links of vital processes, and especially the mechanisms of their self-regulation and regulation will permit purposeful guidance of the tremendous latent reserves of the animate world. Yes, purposeful guidance in a direction desired by man and beneficial to man. This is a very great obligation

especially today because research in recent years in the field of biology, and more especially in the field of genetics, has made possible intervention in the most crucial aspect in the movement of animate matter -- heredity. This intervention has been given the name of genetic engineering and permits forceful interference with -- even guidance of -- the hereditary process. But this intervention, as has already been ascertained, is a two-bladed knife. It can be used to create organisms with useful qualities, but it can also be used in the opposite direction for adverse effects. There is no question but that the way must be cleared for the favorable effects and at the same time the campaign of the world progressive scientific community against use of the achievements of genetic engineering for the satanic purposes of war must be resolutely supported.

The development of the biological sciences in recent years shows intense differentiation, continuous ramification and specialization in individual problems of the basic biological disciplines. And today many narrowly specialized branches are emerging in morphology, physiology, genetics, biochemistry, biophysics, immunology, microbiology, virology -- in general in all branches of biological science which illuminate the processes of animate matter from different aspects. The genealogical tree of biology today is so very ramified that already many things can hardly be expressed figuratively. This intense differentiation of scientific research in the field of the biological sciences makes the reverse process imperative, namely, the integration of the already differentiated specialties for the whole and full illumination of a given biological problem. In this way a number of vital processes in the multivisaged world of animate nature -- from viruses and microorganisms to man -- can be explained.

Research in the field of biology is conducted at five basic levels of the organization of animate matter, namely, molecular, cellular, organ, organismal and supraorganismal (populations, communities, biocenoses, biocosystems in the unified system of the biosphere) etc.

Unquestionably the greatest achievements on a world scale, albeit still inadequate in the opinion of some, were attained recently at the molecular level, i.e., in the field of molecular biology which studies the so-called giant protein molecules or biopolymers that appeared at a certain stage in the evolution of matter and became the foundation for the manifestation of life, of vital processes. According to research in this field, the first signs of life appear as a complex of protein molecules constructed in a special way, which had already received the name of biopolymers. Consequently, in the transition from inanimate to animate matter an essential role falls to the appearance of these complex molecules of these biopolymers of protein matter. And what insight there was in what Friedrich Engels wrote as far back as 1881, that life is a form of existence of protein bodies. Molecular biology emerges as the key biology because all other levels of research (cellular, organ,

organismal) reduce to the deciphering of vital processes in the basic building blocks of animate material -- the molecule and polymers. Among the achievements in the field of molecular biology we can cite such achievements as establishment of the composition and structure of nucleic acids and the part they play in protein biosynthesis and in the transmission of hereditary information, establishment of the molecular structure of proteins and the mechanisms of their biosynthesis, synthesization of the individual gene and the transference of genes from one organism to another (genetic engineering), as well as a number of other achievements which are of great theoretical and applied significance for clarifying the basic processes characteristic of animate nature and its modification.

In consequence, research in the field of molecular biology is in a chain relationship, its results nourishing the sciences studying life processes at a higher (cellular, organ) level, such as morphology, physiology, endocrinology, pathology etc., while the research of these branches nourishes and illuminates research on the general processes of the entire organism, such as the processes of multiplication, growth, development, production, immunity etc. Hence there is a complex interdependence and conditionality, a functional interrelationship, which begins with the molecule and culminates in the entire organism. Or, conversely, the vital processes of the entire organism reduce, in essence, to processes of the organs and cells, going as far as the processes in the biopolymers. This is what makes it necessary, in research on life processes in the field of biology, to make wide use of interdisciplinary research methods that study the mechanisms of life processes simultaneously in the complex chains of their interdependence so as to arrive at regulation and guidance of these processes in a direction desired for society. Otherwise, isolated research on just one level studies processes piecemeal and cannot solve the great problems of modern biological science.

Of unquestionably great interest is the question of the fundamental problems confronting biological science today. These problems are many and have to do with various branches of the complex system of the animate world, but we shall indicate only a few of them.

In the first place is the question of protein biosynthesis. The protein problem today is one of the most vital problems of our planet, involving the feeding of the human race. Today in the Western capitalist countries there is not only an energy and a currency crisis, but more and more acutely felt a protein crisis. And the task set for biological science is, through modern scientific methods, to make more comprehensive use of the vast biological potential of animate nature (microorganisms, microalgae, animals, plants) for protein synthesis. In the field of microbiology, for example, intensified work is under way on study of the dynamics of metabolite processes, the biosynthesis of antibiotics, alkaloids, organic acids and protein substances, as well as on enzyme biosynthesis processes.



In the area of plant-growing, for example, beginning with the lowest plant forms such as microalgae and going as far as the highest cultivated plants, the employment of a number of new scientific methods of genetics, physiology and biochemistry is achieving remarkable results such as finding several plant growth regulators and methods of heightening resistance; some mechanisms affecting photosynthesis are being brought to light; the exceptionally great biological effect of heterosis has been confirmed. Mutagenesis methods are finding beneficial application.

In the field of animal husbandry a number of methods for intensifying the reproduction process and increasing fertility and the impregnation rate have been devised and are being employed. For example, in the field of sheep-raising in our country such biological methods of increasing fertility have been devised as, for instance, twice-a-year lambing of ewes, twinning and multiple pregnancies of ewes, breeding of ewes at an earlier age, additional breeding of cull ewes etc. By these methods tens of thousands more lambs are obtained, and in consequence a larger amount of protein. In 1976 alone, by application of these methods in our country, 55,000 additional lambs were produced, i.e., more than 1,000,000 kilograms of lamb's flesh.

Many important problems are assigned to biology and genetics today involving human health care and human longevity. Rating as the principal tasks facing medical biology today are the questions of regulation of population increase, the campaign against certain ills such as cancer, cardiovascular diseases, atherosclerosis etc.

The central problem raised in the science syllabus of the Seventh Five-Year Plan is protection of the biosphere. And here the problems for rational investigation (regeneration and improvement of biological resources, protection of Bulgarian fauna and flora and their biological equilibrium) are raised with special acuity. This makes it imperative to devise and utilize biological methods for ridding the natural environment of harmful industrial byproducts and for chemical plant protection.

An important question is that of devising methods for the biological control of crop pests. The tremendous damage caused by the various plant pests that lower plant yields is well known. Also well known is the real danger for humans from so-called residual substances such as the pesticides used for the chemical control of plant pests. Residual substances have an injurious effect on bees and wild animals as well as on people who consume even minimal quantities of these harmful chemicals via their food. For this reason the question of the biological control of plant pests is an exceptionally urgent problem which awaits scientific solution.

For successful solution of the aforementioned urgent problems in the field of biology, certain questions (and above all that of decisive improvement

in the organization of scientific research work) are raised in the light of the July plenum of the Party Central Committee. Here the question of interdisciplinary method in the scientific research work in the field of biology is raised with particular pointedness. There is no other sector in science where interdisciplinary research is so necessary as in the field of biology. This interdisciplinary character is dictated by the fact that the life processes themselves in organisms are complex and comprehensive; they are interrelated.

As is known, study of a number of fundamental phenomena of movement and development of animate matter (microorganisms, plants, animals, man) reduces to the study of biopolymers -- the subject-matter of molecular biology. Molecular biology (which some say is the science of the last quarter of the 20th century) is the basic link, which stands in a chain relationship with, and nourishes with its findings, the sciences studying life processes at the next higher levels (cell, organ, organism) such as morphology, physiology, pathology etc. The research of these branches sheds light on the general processes of the entire organism, such as the processes of multiplication, growth, development, movement, reactivity, immunity, production etc. Consequently, there is a complex chain dependence, a functional integration, which begins with the molecule, or rather with its components, and culminates with the entire organism. And, conversely, the life processes of the entire organism reduce essentially to the processes of organs and cells and go as far as the processes in biopolymers and molecules. This is what necessitates interdisciplinary research methods to find a workable realization by studying comprehensively the mechanisms of the life processes and complex chains of interdependence and interrelationship at various levels. It is precisely the interdisciplinary method of scientific research on a particular vital process that makes imperative the participation of both morphologist, physiologist and biochemist, biophysicist, immunologist and other specialists for comprehensive and omnifaceted clarification of biological processes, interrelated in the continuous course of change of animate matter. Otherwise, isolated research on just one level or in just one direction studies processes in detachment or, as they say, "by the piece." This isolated research cannot solve the great problems of modern biological science. The Unified Center for Science and Personnel Training in Biology and Medicobiological Problems of the Bulgarian Academy of Sciences has set up 25 teams for interdisciplinary and specific study of important biological problems. Efforts are being made to conduct genuinely interdisciplinary treatment of these problems. And this is one of the most important tasks of the center in the light of the decisions of the July plenum of the BCP Central Committee.

Another essential task in organizing scientific research work in the field of biology is that in our treatment of different problems and tasks we must carry through completely to our goal until we are in touch with real life, with the practical world. In many cases the study of individual problems and topics produces many interesting data and many

positive results. Unknown facts are described, reliable principles are established, important processes are clarified, all documented in photo-micrographs and established by objective scientific research methods. As scientific achievements they are real. As facts they are correct and many of them discovered and described for the first time in our country. But many of these remain isolated, not specifically related to real-life problems, to a specific goal, and therefore make no real contribution to the solution of any problems connected with real life or the great tasks assigned to Bulgarian biological science. Every subject, every problem, every assignment must be captioned with one indispensable question, namely: Why is it being done, what effectiveness will be obtained, and how will it make the practical world more fruitful?

Another important task in the light of the July plenum is that of insufficient persistence in exploiting the scientific achievements in the field of biology. The exploited achievements still do not match, do not correspond to the great scientific potential or to the splendid scientific achievements in the field of the biological sciences.

Some wrongly assert that a scientist is first and foremost an investigator and his obligations end with the publication of his scientific work. Therefore, they continue, the scientist has no commitment to the process of exploiting even his own scientific achievements. This assertion is utterly wrong. A scientist must see to, must supervise from the standpoint of scientific method, and must monitor the exploitation of achievements which are the result of his scientific work over many years. In this regard, at some institutes of the academy that have valuable scientific achievements, the scientists responsible for these achievements not only keep an eye on, but also participate in the process of exploitation. They are constantly at the plants, on the cooperative land tracts and at the stock-breeding farms. But this commitment must become general for all institutes and for all scientists.

The exploitation of foreign scientific achievements in the field of biology still falls short. Every year the Bulgarian Academy of Sciences sends a large number of scientists abroad to study foreign experience, to specialize, to attend congresses and symposiums. Before they leave, they are all very active and persistent and insist on going in order to study and contribute something new. On their return, however, their activity evaporates and the returnees usually show no interest in exploiting foreign scientific achievements.

We have indicated some urgent problems confronting the biological sciences and we believe that with the existing scientific potential at the disposal of the Center for Science and Personnel Training in Biology and Medicobiological Problems of the Bulgarian Academy of Sciences fulfillment of these tasks is possible given the favorable situation created by the decision of the Political Bureau of the Party Central Committee regarding the development of the biological sciences and given the constructive commitments that we scientists have undertaken since the July plenum.

INTERNATIONAL ASTRONAUTICS CONFERENCE CONVENES IN PRAGUE

Prague RUDE PRAVO in Czech 21 Sep 77 p 4

[Article by Stanislav Stibor: "The Present and the Future of Astronautics"]

[Text] A convention of the International Astronautics Federation will be held in Prague from 26 September to 1 October 1977. The theme of the 28th international astronautics convention, which is to be held on the eve of the 20th anniversary of the launching of the Soviet "Sputnik," the world's first artificial satellite, concerns the practical uses of space technology in the present and in the future. The convention is taking place under the auspices of the Czechoslovak Government, and it is being organized by the Astronomical Institute of the Czechoslovak Academy of Sciences.

More than 900 specialists from many different countries will be meeting in Prague for an entire week. The largest delegations will be coming from the Soviet Union and the United States. However, the groups representing France and the GDR, for example, will also be composed of nearly 100 members, and the Czechoslovak delegation itself will be made up of more than 100 scientists and technicians. In addition to the other groups of specialists coming from countries which are well known as being deeply involved in space research, primarily including the European countries, and the delegates from countries such as Egypt, Australia, Brazil, Sri Lanka, and the Philippines, numerous guests will also be visiting Prague. These will mainly include the wives and relatives of the participating scientists, inasmuch as social programs are an integral part of world conventions, conferences, and symposia.

Czechoslovakia is a frequent and respected sponsor of international scientific meetings. During September of this year we have already served as the hosts of an international conference on electron microscopy, the 20th International Spectroscopics Colloquium, the EQUADIF International Conference on Differential Equations, the Eighth European Conference on Controlled Chemical Synthesis and Plasma Physics, and, in addition to the astronautics convention, there are at least 10 other smaller-scale

scientific conferences with foreign participation that are also slated to be held in this country.

Congresses and conferences held in Prague, Bratislava, or Karlovy Vary, in Mariánské Lázně or in Brno, as well as in Olomouc, the High Tatras, and other places are highly rated for their organizational standards and for the breadth of their scientific and social activities. Interest in holding international meetings of scientists and technicians in Czechoslovakia is so great that we are unable to fulfill the wishes of many world organizations due to the shortage of suitable convention facilities. The principal reasons for the great interest shown in Czechoslovakia as a sponsor of international conferences include the high organizational and professional standards that are maintained in this country, as well as the traditional hospitality of our two nations, tranquil surroundings, and the personal security enjoyed by all participants regardless of their nationality. In this way, too, our republic is fulfilling the resolutions of the Conference on Security and Cooperation in Europe with regard to exchanges of scientific information. Our country insures the best possible conditions and atmosphere for these kinds of activities. It is not coincidental that the representatives of our federal and national governments assume responsibility for the sponsorship of major conferences and congresses.

The attractiveness of Czechoslovakia as a site for such gatherings undoubtedly has something to do with its solid reputation as an organizer of international meetings, but the fact that it is a country which offers tranquility, attractive physical amenities, and personal safety is of no less critical importance. Personal safety, which is quite a rare experience for the residents of some Western cities, as they themselves will admit, is a benefit offered by all of the socialist countries. For instance, a peaceful stroll by night through the narrow streets of Prague's Old Town illuminated only by gas lamps or across Charles Bridge is an unforgettable experience for Westerners, and for many of them it is a "luxury" which they cannot afford to indulge in at home. And so it is no wonder that they sincerely envy us for the opportunities we enjoy in this respect.

Thus, another major world convention opens on Monday. Its agenda will indeed be a wide-ranging one. The convention will open with a ceremonial session devoted to the theme "Space Research--the Golden Decades," which will be summed up in the form of lectures delivered by representatives of Soviet and American astronautics and also of the host country. At the conclusion of these proceedings the convention participants will be assigned to different sections for specialized discussions, which will be primarily concerned with the two main themes of the convention--The Practical Uses of Space Technology in the Present (devoted mainly to a discussion of the applications of communications satellite technology) and The Practical Uses of Space Technology in the Future, which will be dominated by reports on the potential for using industrial technologies in

satellite space laboratories, problems associated with mining minerals from extraterrestrial sources, and so on. This convention will also conduct meetings on aerodynamics, space medicine, rocket and satellite design technologies, scientific research in space, and so on. Young people will also get a chance to express themselves on these issues at the Seventh International Students Conference of the International Astronautics Federation. This diverse agenda will also be supplemented by eight symposia organized by the International Astronautics Academy, including a symposium on communications with extraterrestrial civilizations, a subject area which is the main focus of most of the research work being conducted by the Czechoslovak scientist and corresponding member of the Czechoslovak Academy of Sciences, Rudolf Pesek, who is also vice president of the International Astronautics Academy. And if we wanted to add to the list of all these activities a detailed report on the session of the International Institute for Space Law, then we would be able to enumerate a list of more than 400 separate papers.

Let us hope, then, that by the end of next week all of the participants in the 28th International Astronautics will leave Prague with a sense of satisfaction over the results of the convention's proceedings. Let us also hope that they will leave with pleasant memories of their entire stay in our republic.

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CSO: 2402

CEMA COOPERATION IN MOLECULAR BIOLOGY RESEARCH

Prague RUDE PRAVO in Czech, 31 Aug 77 p 4

[Article by Josef Riman, corresponding member of the Czechoslovak Academy of Sciences, director of the Institute for Molecular Genetics of the Czechoslovak Academy of Sciences]

[Text] Molecular-biological and molecular-genetic research concerning living systems has an irreplaceable place in biological sciences in the process of clarifying the nature of functional manifestations of living systems. The findings made on the subject are a prerequisite for rational influencing of living matter, of the creation of basically new and economically advantageous technologies in vegetable and animal production, in discovering new, nontraditional sources of synthesis of specialized components of nutrition and biologically active substances, rational prevention, timely diagnostics and control of a number of the so-called civilization diseases and disturbances of metabolism conditioned by hereditary factors. Finally, this trend of biological research is becoming tremendously important today, even from the point of view of the possibility of building artificial and new genetic groups of living systems.

The important mission of this research was emphasized in the resolution of the CPSU Central Committee and of the Soviet Council of Ministers on the development of molecular biology and molecular genetics in the USSR dated in May 1974, and especially by the documents of the 25th Congress of the CPSU.

High Level of Soviet Biology

The result of continuous care of party organs and government of the USSR is the present high level of molecular-biological and molecular-genetic research in the Soviet Union. Its impressive and technically modern base of high quality represents at the same time a solid foundation

of the continuous successful development of this trend of biological research in the entire socialist community. Indeed, the contemporary molecular biological research needs perfect cooperation of a number of specialized biological fields, particularly biochemistry, biophysics, and other scientific fields, for example physics, bio-organic chemistry, and computer technology.

The successful operations of this research are conditioned by correct division of labor and specialization. Its demands exceed frequently the facilities of one single work center, in fact even the facilities of the scientific research base of one single country. For all these reasons, biological molecular research is predestined for close and extensive cooperation and integration. And this is being done in the case of the socialist countries.

A successful example of cooperation and effective division of labor between the Czechoslovak and Soviet molecular biological research is cooperation on the tasks of the Revertaza project, which is part of multi-lateral cooperation of the academies of sciences of socialist countries in the field of molecular biology. This project -- designated by the name of the first instrument of "genetic engineering", namely the revertase enzyme, which makes it possible to transcribe hereditary information in the genetic form -- was set up in 1972 at the instigation of the Soviet Academy of Sciences, which also coordinates the project. By its thematic content, the project belongs to the area of "genetic engineering" and concentrates on studies of cellular and virus genes, particularly on studies of the genes animal viruses of the tumorous, leukemic, and sarcomatous type.

#### Effective Division of Labor

A number of academic and departmental centers in the USSR and GDR participate in this project at the present time. Czechoslovakia is represented in it by the Institute for Molecular Genetics of the Czechoslovak Academy of Sciences. The direct partners are the Institute for Molecular Biology of the Soviet Academy of Sciences, the Oncological Center of the Soviet Academy of Medical Sciences, and more recently also the Institute for Molecular Biology and Genetics of the Academy of Sciences of the Ukrainian SSR, and the work center of the Siberian Division of the Soviet Academy of Sciences.

The subject of this cooperation is a study of the properties of molecular carriers of hereditary information of tumorous viruses. The joint utilization of Czechoslovak techniques and experience derived from isolation of information virus molecules and construction of models of cells transformed (changed) by a virus, as well as Soviet experience and enzymological techniques and genetic quantitative analyses led within a relatively short time to qualitative results, which are published jointly in selected international scientific periodicals. An example of this can be isolation of the basic viral information unit, which up to now is functionally



the most active unit, and the explanation of its activity in the transcription of information. Another example in this respect can be the discovery of a model system of a cell transformed by a virus, which makes it possible to study the manifestations of two specific viral genes and to isolate their information molecules.

In addition to the results of this cooperation in studying the subject, both participating parties have also stimulated the research at their places of work on a larger scale through mutual exchange of special scientific material. Czechoslovakia has been supplying from the very beginning the enzyme for feedback transcription of genetic information and takes care of the lectures on the subject of the technology of its preparation. This is made possible by the Czechoslovak instrumental and scientific base, which has been set up with a head start and is evaluated by the Soviet coordination center as a unique base in Europe. The Soviet scientific base supplies Czechoslovakia with the required special enzymes, radioactive compounds needed for a quantitative genetic analysis.

This cooperation, the successful course and its gradual intensification have become a good school which is discovering the generally valid rules of successful socialist integration. It has demonstrated vividly that the degree of cooperation and integration always depends directly on the degree of preparedness of the operational teams on both sides, on the mutual optimal specialization of the teams, and on clear definitions of the tasks. Last, but not least, it depends also on deep interest in the common cause, on efforts to reach as fast as possible the target, which in this case consists in priority findings of high quality on the part of socialist science in the area of molecular research concerning living systems and their peaceful utilization.

5668

CSO: 2402

OPERATIONS OF NUCLEAR RESEARCH INSTITUTE OUTLINED

Prague RUDE PRAVO in Czech 21 Sep 77 p 4

[Article by Vladimir Balek]

[Text] This week Czechoslovakia's first experimental nuclear reactor located at the Nuclear Research Institute in Rez near Prague will have been in service for 20 years. On 23 September 1957 at 2352 hours a controlled nuclear reaction took place for the first time in Czechoslovakia using equipment supplied by the Soviet Government for the purpose of aiding in the construction of a Czechoslovak center for the study of the peaceful uses of nuclear energy. By now this system has 50,000 operational hours to its credit. During this period up to 8,000 specimens have been subjected to irradiation tests in the reactor's active zone. The test results that were published in professional journals have received much praise both at home and abroad, and the radioactive isotopes produced in the reactor have been helpful in solving many problems.

As the years passed the Nuclear Research Institute has given increasingly higher priority to applied research projects. Especially after 1972, when the institute was placed under the jurisdiction of the Czechoslovak Atomic Energy Commission, there was a marked increase in the proportion of research and development projects geared toward laying the groundwork for the construction of nuclear power plants and other nuclear facilities in the CSSR.

Technological loops have been installed in the reactor's active zone that make it possible to simulate the operational conditions of the primary cycles of nuclear power plants, including radiation effects. Since the beginning of the 1960's the so-called CO<sub>2</sub> loop has been used to study the operational parameters of nuclear power plants with carbon dioxide cooling systems, and the results of these studies were put to use in Czechoslovakia's first nuclear power plant, the "A-1" in Jaslovské Bohunice. A water pressure loop has been in operation since 1964. It was used to develop techniques for controlling operational modes and to study radiochemical changes in light-water reactors of the late-model Voronezh type, which form the basis for the future development of the Czechoslovak nuclear power industry.

Staff members at the institute in Rez are also engaged in the study of problems associated with the types of materials used to build nuclear reactors. For instance, steel specimens supplied by the Skoda enterprise in Plzen have been irradiated in the reactor for long periods of time in order to study their durability under the impact of operational conditions, primarily in order to determine the effects of heavy radiation on changes in their mechanical properties. The recent remodeling and modernization of the institute's facilities resulted in an increase in the reactor's neutron flux and power output capacity and significantly improved conditions affecting radiated materials studies.

Joint Czechoslovak-Soviet research projects aimed at studying problems associated with the operations of sodium-cooled fast-breeder reactors have also taken place at Rez. The principal advantage of these second-generation reactors (it is expected that such reactors will be built in the CEMA countries by some time around the turn of the century) the efficiency of their nuclear fuel utilization rates is nearly 100 times greater than that of current systems. The experimental reactor belonging to the Nuclear Research Institute, which initially was the only system of this type in Czechoslovakia, has also been used to aid the work of many different organizations, research institutes, and schools.

The institute's reactor has been put to practical use through the production of radioactive isotopes. For example, owing to its relatively short half-life (15 hours) and its suitable beta ray generation properties, the sodium radio isotope,  $^{24}\text{Na}$ , is being used to solve various technical problems in industry. The reactor has also been used to study the evenness of cement dispersion in prefabricated construction panels, the melting speed of materials in glass-making furnaces, the density of furnace walls, and so on. A radioactive isotope of gold, small quantities of which are combined with other alloying substances and added to steel, has helped workers of the Ferrous Metallurgy Research Institute to approximate a process for smelting steel.

Agricultural specialists are also included among the patrons of the experimental reactor at Rez. The irradiation of agricultural products can produce mutations which can be used to generate new hybrids with more desirable characteristics; in the case of peas this procedure has resulted in the attainment of greater harvest yields, and a lentil hybrid has been produced that is more resistant to viruses. Similarly, the reactor has been used to irradiate grafts for apple trees in order to enhance the quality of new hybrids.

Another important research technique involving the use of the experimental reactor is neutron activation analysis. Using this method it is possible to produce artificial radioactivity through the bombardment of non-active substances with neutrons. This is one of the most sensitive methods of chemical analysis, which makes it possible to take a very small specimen (weighing from 1 to 3 milligrams) and quickly identify a wide range of

elements in quantities as minute as millionths ( $10^6$ ) or billionths ( $10^{12}$ ) of a gram. This nuclear research method is being used successfully by workers of the Czechoslovak Geological Survey in order to ascertain the presence of traces of elements in ore and mineral samples. It is also proving to be helpful in the field of criminology in connection with the non-destructive analysis of isolated evidentiary materials. By means of neutron activation analysis workers at the Nuclear Research Institute were able to identify 20 to 30 elements in a single granule of power plant waste ash, and this helped them to determine the principal sources of air pollution in selected test areas. To cite another example, this method has also been used to isolate certain elements (such as mercury) present in food-stuffs.

Of all the nuclear reactors in operation in Czechoslovakia the experimental reactor at Rez has proven to be the most suitable for the production of radiopharmaceuticals. Medicinal preparations have been synthesized in the institute's laboratories that are labeled with the iodine radioisotope  $^{131}\text{I}$ . This radioisotope, which is obtained by bombarding a compound of tellurium with neutrons, is used to aid the medical research of certain organs. Bengal red [Bengalska červen] labeled with iodine  $^{131}\text{I}$  is used in the study of liver disorders, and orthoiodine-hippurate coded with the same radioisotope is used in kidney research. This kind of research based on the use of high-quality radiopharmaceuticals eliminates the need for painful exploratory surgery and makes it possible to arrive at more precise diagnoses. Consequently, this method is being used on an increasingly broader scale by our medical profession. While in 1971, 40,000 medical examinations were made in Czechoslovakia using radioactive isotopes, the total number of these examinations increased to 200,000 in 1976, and by 1980 it is expected that the number of such examinations conducted every year will reach half a million.

Thus, the first years of the 20-year history of the operation of the experimental reactor at Rez made a significant contribution to the advancement of nuclear research and the utilization of ionization radiation and radioisotopes in Czechoslovakia. At the present time the operation of this reactor is characterized by research projects geared toward the accomplishment of specific tasks designed to promote the growth of the Czechoslovak nuclear power industry.

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CSO: 2402

## CZECHOSLOVAKIA

### SCIENTIST OUTLINES FUTURE DEVELOPMENT OF BASIC RESEARCH

Prague TVORBA in Czech No 33, 17 Aug 77 p 11

[Article by Karel Friml, corresponding member of the Czechoslovak Academy of Sciences]

[Text] The development in the world confirms clearly that an advanced society cannot be conceived without a continuously growing influence of science. This applies especially to a socialist society, in which science and the social system are integrally related to each other. This vital relationship between science and socialism is of a far-reaching significance for the contemporary era. Science is becoming gradually a production force. In order to apply its results in social practice, new and closer relations are being created, and in this way science helps indirectly to increase the material well-being of the people. Of course, the importance of science cannot be reduced merely to the production area. Significant results are produced also in the creation and protection of the living environment, in consolidation of physical and mental health of man, in purposeful management of the society, in the ideological struggle, and in the overall education of the socialist man.

The instrument of management of research and development in Czechoslovakia is the state plan of the development of science and technology, which is an inseparable part of the state plan for the development of the national economy. The main tasks of basic research are specifically formulated in this plan by state programs of basic research. Their planning, coordination, and control are provided by the Academy of Sciences in closest cooperation with advanced schools and the appropriate ministries.

The CSAV [Czechoslovak Academy of Sciences], acting jointly with the entire scientific-technical front, has been paying attention systematically since 1973 to the preparation of the state plan for basic research concerning the Sixth Five-Year Plan. About 800 leading scientists and leading specialists in social practice participated in the preparation of this plan in organs, which were directed by the CSAV in its planning, coordination, and control. Organizations which shared in an important way in the preparation of the plan were units for management of science

and research of both national ministries of education and other 14 ministries. Opinions concerning the tasks included in the plan were given by the majority of ministries interested in the matter (altogether 32 of them) and those general directorates with which the CSAV has an agreement on cooperation. The result of this confrontation was a draft of tasks which by their orientation and planned goals correspond to the handling of the areas and which were outlined for basic research by the 15th Congress of the CPCZ.

In addition to work centers of the Czechoslovak Academy of Sciences and the Slovak Academy of Sciences as well as national ministries of education, 15 work centers under the jurisdiction of federal ministries participate in handling the tasks of the state plan of basic research, 13 of them under the jurisdiction of Czech central organs and 21 under the jurisdiction of Slovak central organs.

And so, the state plan of basic research for the Sixth Five-Year Plan represents a significant instrument of coordination of the Czechoslovak basic research at the federal level. The presidium of the CSAV will continue to give priority in the course of the Sixth Five-Year Plan to studies and control of selected key tasks from the point of view of creating conditions for applying the results obtained in social practice. As early as in the current year, results are expected which may have a direct impact on social practice and may bring significant effects in the national economy and other significant social effects, as indicated by the following examples.

In the area of expansion and complex utilization of domestic raw materials as well as rational production and revaluation of materials, a technological process will be worked out for electrolytic zinc-coating and melting, which will make it possible to regulate the thickness of the layer and will accelerate substantially the entire process. A functional prototype of equipment will be developed to test the results and to obtain data for a proposal of an operational production line.

A technology of the production of permanent magnets based on cobalt and rare earths will be proposed 1 year ahead of time. These magnetically hard materials are very important for miniaturization in electronics, microwave technology, and electrotechnical engineering. For the time being, they are manufactured only in a few capitalist states, and there is embargo on their export to socialist states.

In the area of effective procurement, transmission, and the utilization of energy, the CSAV will complete a complex of operations designed to deal with transsonic flow in blade grids. The results will be applied in practice in a proposal and construction of large turbines and compressors and in the future development of aviation jet motors.

A digital method will be completed for computation of nonlinear magnetic fields, and will be applied in computing the distribution of the magnetic

field in individual parts of electric machines. This method will be delivered in the form of a program to the Research Institute for Rotary Electric Machines in Brno, where it will be used in designing a new series of asynchronous motors within the framework of the Interelektro international program of CEMA.

Completion of the technology of synthesis of GaP monocrystals will be important for the development of electronics and optimization of the control of complex processes. The introduction of this technology will help to reduce imports of costly materials from capitalist states and to develop miniaturization of electronic indication elements.

In the area of protection and creation of the living environment, the results of the research based on the example of Slovakia will make it possible to clarify the spatial laws of the topography of the country, where mountainous areas are predominant over lowlands. These findings will be applied in economic exploitation of the country and as the basis for integrated research of the country within the framework of CEMA. Also, various types of relationships between nature and society will be processed theoretically on the systemic basis, and a theory will be created concerning the country, which will help to solve the problem of the living environment of a socialist society.

The work on the system of planned management in the area of the development of socialist production forces and relations as well as improvements of planned management will produce materials in a synthetic form for dealing with current questions of the Czechoslovak economy.

The monograph "The Class of Manual Workers in the Automation Process" (which has been prepared within the framework of an international problems commission) will study changes in the subjective component of the production forces in the process of creation of a developed socialist society under the conditions of scientific-technical revolution, and will concentrate on revealing changes which take place within the class of manual workers.

The given examples show that the relations between basic research and practice are applied particularly along the line of technical development.

What also contributed significantly to closer relationship between scientific research and production was cooperation with industry, developed on the basis of agreements signed between the CSAV and branch directorates of selected important economic-production units (for example Skoda Works, CKD, Tesla, Spofa, and so on). The Academy will continue to develop cooperation with large industrial enterprises, and will seek new ways to bring about better integration of individual elements of the cycle "research-development-production-application".

An important condition of successful fulfillment of the basic research plan for the Sixth Five-Year Plan is the development of international

scientific cooperation, improvements of its forms and efficiency. Three-quarters of contacts of Czechoslovakia with foreign countries are contacts with socialist countries. The international socialist division of scientific work is becoming a significant factor of efficiency and acceleration of the scientific-technical development.

An example of the highest forms of this cooperation is Czechoslovak participation in space research within the framework of the Interkosmos program and in the work at the Joint Institute for Nuclear Research at Dubno near Moscow. In both cases, we are dealing with demanding and complex types of research, which because of their complexity and scope could not be handled by any small state alone.

In the years of 1976-80, the number of tasks dealt with jointly with the Soviet Union has increased in comparison with the previous five-year plan by more than half, while it is expected that social tasks will increase by one-third in other socialist states. This cooperation is developing altogether with regard to 90 percent of all the tasks of the state plan and basic research. On the basis of the principles of mutual advantages and internationalism, scientific-technical contacts will be also expanded with advanced capitalist and developing countries.

However, an indispensable condition of the given demanding but realistic tasks of the Sixth Five-Year Plan is a broad development of the initiative of the working people in all basic research centers, scientific and scientific-technical workers, as well as technicians, laboratory workers, and administrative personnel. Numerous individual and collective obligations of great value, complex rationalization brigades and brigades of socialist labor have shown clearly how sincerely are the workers of the institutes striving to apply the theoretical results in practice. It is the result of trust, which the party has gained by its realistic policy, the result of an atmosphere of creative search and responsible approach to the tasks of the development of the Czechoslovak society. That is why basic research in Czechoslovakia is proceeding to apply the conclusions of the 15th Congress of the CPCZ under good conditions and with full responsibility.

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CSO: 2402



#### NEW DEVELOPMENTS IN ADP APPLICATION REPORTED

East Berlin MILITAERTECHNIK in German No 9, Sep 77 signed to press 6 Jul 77  
pp 397-400

[Report by Maj Dr G. Stabrey, economist, engineer, on 'INFO 77, Scientific Conference on Comprehensive Problems of Data Processing': "Basic Development Trends in the Employment and Use of Data Processing"]

[Text] The scientific discipline of data processing is an essential means for the acceleration of scientific and technical progress and an important factor in socialist intensification. This was one of the reasons for calling together a scientific conference dedicated to comprehensive problems of data processing, INFO 77. Its aim was to inform the scientific workers at computer centers about results and directions of basic and applied research on comprehensive problems of data processing. It presented an overview of selected research problems in this area and familiarized the audience with national and international directions of development.

Since electronic computing technology is used in the National People's Army as well as in the GDR Border Guards, the numerous results of the conference are of general interest as well as being of specific concern to the reader working in the area of mechanization and automation of troop command. This is true for the effective utilization of existing technology as it is for the further development of automated command systems. The following will therefore discuss in more detail some of the problems discussed at INFO 77 which deal with the structure of automated command systems.<sup>1</sup>

#### 1. Development of Computer Nets and Aspects of Computer Network Research

Professor Dr Meier (GDR Academy of Sciences) in his keynote address dealt with the construction and development of computer networks ([1], pp 59-76). Starting with the requirement that the computer system as production tool be continually perfected, he determined, that, in spite of the great potential of data processing which we have today, we are still only at the beginning of a development, which, at this stage, can hardly be foreseen. At the present time there is a notable transition from the utilization of autonomously operating computers to the use of machines systems in the

form of computer networks. Productively working data processing systems of this sort already exist while other projects are being designed or completed. "Some computer networks have transcended the frontiers of countries and continents. Thought is given in many places to the problems associated with computer networks on a national scale. Large international connecting networks are under discussion." ([1], p 60)

A direct connection exists between the construction and development of computer networks and questions regarding principles of architecture,<sup>2</sup> data transmission equipment, modes of operation, problems of reliability, and computer-computer interactions. Thus a uniform language concept has to be formed to allow the user to utilize comprehensively the manifold possibilities of a computer network. It is also necessary to develop program packages and systems that are not dependent on a specific type of machine and to proceed to computer assisted software resource selection.<sup>3</sup>

In his talk, Professor Dr Meier defined the functions of a computer system and drew up five types of computer subsystems. He classified the computer systems from the standpoint of the computer network and described network structures and subsystems of a computer network while discussing problems of architecture and perfection of computer networks.

Moreover, during INFO 77 some aspects of computer network research and the intimately related investigations in remote data transmission and processing were dealt with principally in Section IV. Dr Hammer (GDR Academy of Sciences) began by noting the tendency that systems are being developed and built that consist of coupled computers as well as shared computers and computer networks. "This trend is supported by the need to use available computing capacity, especially that of big computers, as effectively as possible by enabling access by the user to as large a selection of hardware as well as software resources. Moreover, all demands of a computational nature must be satisfied by suitable resources." ([2], p 3)

This development leads to an ever increasing separation between the user of computer equipment and the equipment proper. The user generally does not care where his computations are carried out. What is important for him is that he have access to a computer network by means of suitable, effective terminals<sup>4</sup> and that he can use the resources of the computer network in such a way that all of his needs in regard to format, quality and quantity as well as time are satisfied. Just like electrical energy can be withdrawn from an electrical net by way of an outlet without the place of production of the energy being of any concern to the user, so should a computer network make available to every user hardware and software resources.

The development and construction of computer network requires the solution of many complicated problems. "Compared to work with isolated computers, a completely new requirement is that of network control for the

organization of the distribution of a user job to possibly several computers and making available the necessary program and data resources." ([2], p 3)

In addition, the following interesting problems were discussed in Section IV:

- construction and interfacing of terminals to a computer network;
- organization and control of processes which are located on different and distant computer systems and communicate with each other;
- operating system of a computer system;
- transmission of data batches between computer systems;
- organization of computer communications;
- availability and organization of data transmission nets taking into account differences in performance demands, security, reliability as well as transmission technology;
- integration of ESER computers in computer networks; and
- analytic computer network models.

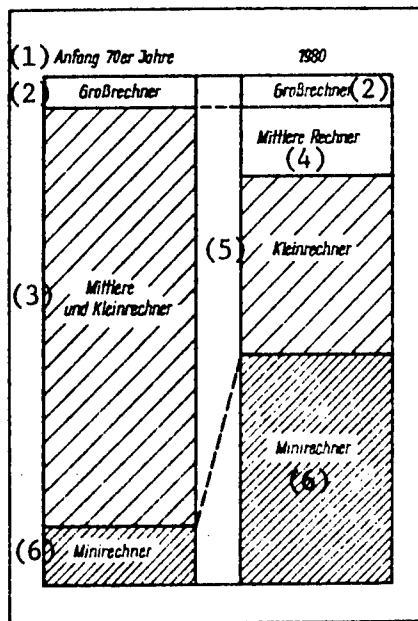
## 2. Causes of the Development of Computer Networks

Dr A. Butrimenko (USSR) ([1], pp 30-50) spoke at this session on the theme "Technical and economic causes of the origin and development of computer networks."

He departed from the premise that in the last few years development has been characterized by the fact that a number of national and international computer connecting systems were created. This development was based on the idea of effective utilization of computers. The talk examined the notion whether there might not exist another important reason for this development besides some progress in data transmission and the interconnection of computers. In this connection Dr Butrimenko established that "the number of users is steadily on the increase, that computers have steadily become less expensive, that one can observe a strong shift of electronic computers toward the minicomputer which also has led to a notable increase in the number of computer users." ([1], p 30)

Figure 1 displays the relative distribution of four well defined classes of computers (big computers, medium sized computers, small computers, and minicomputers) at the beginning of the 1970's and the expected distribution in the year 1980. It is apparent from this presentation that the fraction of large machines remains the same, whereas that of the

minicomputers is considerably increased. The fraction of medium and small machines decreases. This conclusion is supported principally by the decrease in price, the enormous improvement in performance, and the relatively inexpensive maintenance of minicomputers.



Key:

1. Beginning of the 1970's
2. Big computers
3. Medium and small computers
4. Medium sized computers
5. Small computers
6. Minicomputers

Figure 1. Relative Distribution of the Classes of Computers at the Beginning of the 1970's and in the Year 1980 ([1], p 41)

"The increased number of installed minicomputers is accompanied by a notable increase in the number of users who have direct access to a computer." ([1], p 34). This tendency is not in contradiction to the development of computer networks.

Dr Butrimenko's analysis of costs of running the installation, of equipment and of personnel as a function of the intensity of computer utilization is of interest (Fig. 2). The expenditures for personnel were, according to these data, 46 percent of total costs. Although total costs will drop, the fraction of the total made up by this item will increase until 1985. This means that the human being will occupy a dominating position even in the future framework of automation of data processing.

The principal costs are not attributable to "the area of hardware and computing times, but in the areas of software and effort to run the computer center and maintain programs up to the latest standards. The increase in number of users and the simplified access to the computers require more specialization at the computer centers and a higher level of programs and systems which in turn leads to increased personnel costs." ([1], p 30)

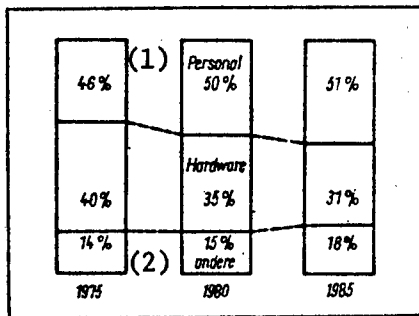


Figure 2. Expected Trends in a Typical EDP Budget ([1], p 43)

Key:

1. Personnel
2. Other

Dr Butrimenko sees a solution to these problems in connected computer systems through which components such as software and personnel can be divided.

### 3. Architecture of Electronic Data Processing Installations

Problems of the architecture of electronic data processing installations were treated by Professor Dr Merkel (The Robotron Combine VEB). ([1], pp 77-90)

He clarified the concept of computer architecture,<sup>2</sup> established requirements for electronic computer installations, and derived general principles and characteristics for architecture. ([1], p 79)

Starting with an analysis and evaluation of the state of development of present electronic computer installations Dr Merkel determined that one must not count on overcoming faults and contradiction through a qualitatively new type of machine in the sense of revolutionary changes in the next few years. "Removal of insufficiencies will be accomplished mainly by particular improved solutions, especially through expanded parallelism, the extension of decentralization of control, storage, and processing as well as by increase in flexibility. The invention of new solutions will be supported by the meteoric development of semiconductor technology with regard to speed increases of bipolar switching circuits accompanied by increased integration and decreasing costs as well as by the transition to large-scale-integrated switching circuits, in particular in the n-MOS technology, accompanied by great decrease in cost." ([1], p 82)

During the 1960's the architecture of electronic computer installations was determined by principles such as multiprogram processing, time share technology, remote processing, and real-time processing. However, the system of modules of electronic computer technology (ESER) and the system of small computers of the socialist countries (SKR) are distinguished by the following directions of development:

--parallelism will be expanded by means of multi-processor systems, pipeline processing principles and multi-computer systems in the sense of a computer network. (In computer installations of ESER II the operating system will support up to four computer systems.)

--storage, processing, and control will be decentralized.

To this end storage hierarchies are fashioned with optimal speed match between the processing unit and the storage unit at the highest level. Moreover, a very large main storage is simulated with the aid of the principle of virtual storage by means of a main storage of limited size and a fast disc system which physically provides the entire storage capacity. Virtual memories are used in all computer models of the ESER II family while buffer memory is available with models EC 1060 and EC 1065.

Data processing and control are decentralized by means of peripheral processors, data bank processors, communications and memory access computers, and programmable subscriber terminals. The number of subscriber terminals in conversational mode which can also be used as independent small computers will increase. Their flexibility of interconnection and data transmission will improve. Block multiplex channels will be utilized and the performance of the processor will be increased by factors of from 10 to 50 as a consequence of the use of special modules.

--Micro processors and small computers will see a transition to the BUS concept.<sup>5</sup>

Professor Dr Merkel indicated that micro-processors are components of second generation SKR and that micro-processors at various performance levels and following a modular structure are being developed and fabricated.

#### 4. Programmable Cathode Ray Terminal PBT 4000

During INFO 77 at a special equipment show by the Robotron Combine VEB the programmable CRT terminal PBT 4000 was exhibited (Fig. 3). It is an independently programmable CRT terminal which represents an efficient work station for communication with the various processes as well as the computers of the family Robotron 4000 and other small computers. This capability is made possible through the use of a micro-processor as controller.

The control unit of the PBT 4000 is a micro-processor ROBOTRON ZE1 (Fig. 4) whose chief components are the CPU chip U 808 and a semiconductor memory. The U 808 makes possible operation times between 13.5 and 49.5 s. [Translator's note. This should probably be milliseconds.] It is a 1 chip unit in MOS/LSI technology.

#### 5. Communication With the Computer

The special problems of communication with the computer were discussed during INFO 77 in section 1 [3]. Here Dr Polze (Humboldt University, Berlin) made the prediction that direct communication between man and computer installation will be the dominant technological determinant of

computer technology in the GDR. The potential of existing data processing systems will be enhanced thereby.



Figure 3. Programmable CRT Terminal, PBT 4000

Problems of communication with the computer were discussed by experts from various points of view. These ranged from questions regarding problem oriented conversational systems for special applications to general conversational systems that are independent of concrete applications and were designed as partial operating systems which eventual users must fashion into conversational programs or program systems.

Special note must be taken of those contributions that addressed problems such as:

--measurement and evaluation of the performance capability of a computer system,

--output of graphic information by means of plotters,  
--man-machine communication in natural languages, and  
--rationalization of scientific work through man-machine communication.

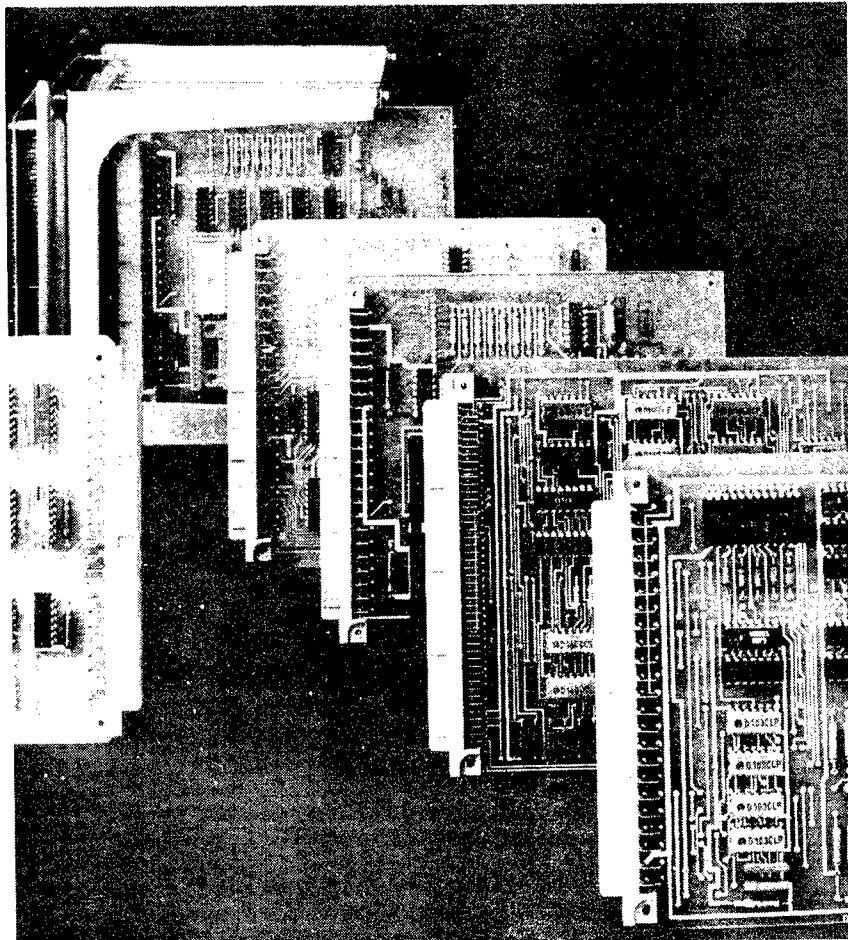


Figure 4. Microcomputer ROBOTRON ZE1

## 6. The Principles of Programming

The papers presented in Section III give an overview of the methodology of programming, of program packages, of data banks, and of system programming [4].

Professor Dr Herrlich (Technical University, Dresden) held that in the next decade the processing speeds and memory capacities will grow by orders of magnitude. This will result in greater demands on programming. The required programs constitute a bottleneck that can only be removed by increasing programming productivity.



In this section interesting problems such as the following were discussed:

- development of data banks, status and perspectives;
- classification and evaluation of data bank operating systems;
- accomplishment of systematic programming in practice;
- methodology for the solution of problems by means of EDVA;
- problems of the architecture and control of program packages.

One of the most important theses, according to Professor Dr Herrlich, is that testing and maintenance of programs require efforts out of all proportion. The requirement of a clear, logical basic concept at the highest possible level of abstraction and its comprehensible and understandable implementation in view of other requirements (such as running time and memory optimization) have clear priority. "The goal must be set to produce correct programs right from the start, rather than to eliminate only a portion of the errors by means of lengthy test runs and error analyses, which resulted from the lack of systematic work." ([4], p 314)

## 7. Concluding Remarks

The research results presented by scientists from theory and practice and the indicated development directions of basic and applied research worked out at INFO 77 mesh directly with the problems posed in the area of electro technology and electronics by the Central Committee of the Socialist Unity Party at its Sixth Congress in June 1977. To solve these problems it is necessary to redouble efforts everywhere. To this end it is necessary to carry on the fight for top performance in science and technology and to raise the level of science and technology especially in such principal directions as microelectronics, control and automation technologies, and the construction of scientific apparatus. For this it is essential to utilize effectively the available scientific personnel and to expand it.

## FOOTNOTES

1. With regard to special interest questions the reader is referred to the comprehensive transactions of the sessions (also see literature references) which the sponsor has made available to the participants. The author of this contribution leans heavily on this material as well as on his own notes and addresses himself chiefly to those problems that are of general interest to a military technology audience.
2. The concept of computer architecture encompasses general structural and functional principles of electronic computer installations from the users viewpoint without, however, taking into account physical realization and logical design. ([1], p 77)
3. Computer assisted software resource selection means automatic algorithm selection taking into account the available hardware resources.

Hardware is the totality of the technical (physical) parts of a data processing installation. The software includes all of the programs made available by the manufacturer of a data processing installation (operating systems and applications software).

4. Terminals are data destinations. They are connected to central data processing installations and serve them for data in- and output.
5. The BUS is a collective conductor. It consists of a certain number of conductors to which the individual logic circuits are tied.

The great progress that has been made in large scale integration of unipolar logic circuits has resulted in the realization of a large number of functions in one circuit. At the present time a 1K memory circuit where every bit is addressable has 10 address inputs, one information output, two current supply leads, and three control inputs. These conditions lead to computer construction with a BUS.

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8828  
CS0: 2300

## HUNGARY

### COMPUTER INDUSTRY EXHIBITS AT BUDAPEST 1976 SPRING FAIR NOTED

Budapest SZAMITASTECHNIKA in Hungarian Jun 76 pp 1, 2, 3

[Article by Melinda Szabo]

[Text] Whoever expected to find surprising innovations and entirely new technical solutions at this year's BNV [Budapest International Fair] computer-technology exhibit was no doubt disappointed after leaving Exhibition Hall A. Relatively few new devices were shown at the stands of the Hungarian enterprises and also at most stands of foreign exhibitors. However, we learned very much about the way in which the computers and their associated equipment could be used for a wide variety of purposes in a successful and effective manner. This was also the goal of the KSH [Central Statistical Bureau] institutions. The exhibits of these institutions informed the visitor about software supply, training courses, technical services associated with the imported ESZR [Unified Computer System] equipment, and computer-technology information sources. The visitors also obtained information about the progress of the ESZR project, and the promising advances resulting from specialization and cooperation. But they also noted some duplications (for example in the field of minicomputer development and production). From conversations with the exhibitors one could obtain a general impression about the expected developments in the spreading of computer technology in Hungary over the next few years.

Among the devices exhibited by VIDEOTON, the VIDEOTON 1010 was a new device. This is a developed version of the ESZ [Unified Computer] 1010. The innovations concerned primarily the solid-state memory and the new terminal console. These innovations significantly improved reliability. New magnetic disk and magnetic tape storage devices reduced the prices. The capacity of the magnetic-disk memory of the VIDEOTON 1010 may be as high as 20 Mbyte. The device is intended primarily for industrial enterprises for operative production guidance, real-time management, and warehousing systems.

The R-12 — with which we became acquainted at last year's exhibit of the SZKI [Computer Technology Coordination Institute] — was also exhibited. The 0th series of this unit is now in production; the series manufacture is scheduled to start next year. Insofar as performance is concerned, this VIDEOTON exhibit will significantly surpass the capabilities of the R-10. It has increased computation capacity, high-capacity disk memories, and high-speed magnetic tape units; thus, it will perform at the level of medium-size computers. The R-12 can use the program base of the R010 without any restrictions and has also the capability of establishing effective database management systems, among others.

The series manufacture of the VIDEOTON 50 business computer family is also scheduled for next year. This family was developed on the basis of the VIDEOTON 1005. These small computers can be used to best advantage in decentralized management systems and small economic entities. In addition to independent use, they may also be used as terminals of the large computers of the VIDEOTON 50 system. Three members of this family, the 51, the 52, and the 54, were exhibited at the BNV.

This year, ORION exhibited several computer-technology innovations: the AP-TEST terminal control simulator, the DATEST-2 data-transmission checkout device, the MOHA-96 calling and conversation unit, and the Modems 1200 and 1400.

The AP-TEST is a control simulator used during the startup of computerized data teleprocessing networks, their operation, and servicing. It generates realistic operating conditions for a given task independently of the operating mode of the computer. This approach permits fast error localization and checkout, without interference with the operation of the full system. It also permits the local checkout of the on-line operation of remote data stations. The AP-TEST is capable of simulating the control function of the computer according to the prevailing data traffic mode, corresponding to the data stored in the replaceable programmed solid-state memory (PROM), or data read in from perforated tape, as well as data set with a series of switches.

The DATEST-2 is intended primarily for service functions in data teleprocessing systems or simple point-to-point data transmission connections. The device checks the basic connection modem and the communication channel section.

The MOHA-96 ensures the output of signals and the conduct of conversations through telephone lines. Its special function is to perform this basic function jointly with devices containing data circuits (such as modems), alternatively with data transmission. The design of the device is such that it may be used in conjunction with all modems meeting the specifications of the ESZR and the CCITT [International Council of Telegraphy and Telephony]. One version of the MOHA-96 may also be used as a single-frequency LB [local] telephone.

The Telephone Factory, which celebrates the 100th anniversary of its foundation, showed many of its products at the fair. In accordance with its obligations in connection with the ESZR program, the factory develops and manufactures data-transmission modems, line connectors, subscriber stations for data teleprocessing, and the like. Its exhibit included the members of the well-known modem family, including the semi-duplex TAM 600 and TAM 6.01, and the duplex TAM 200. From among the subscriber stations, the 200 bit/sec TAP-2-ESZ was shown (it has the peripheral units ER 40 reader, EP 35 perforator, and CONSUL 260 typewriter) and the 100 bit/sec TAP-70 (it has the peripheral unit CONSUL 260 typewriter).

The high point of the exhibit was the TMX 2400 (ESZ 8421) remote multiplexer, which has already been evaluated on the international scale in December of last year. (This device was described in detail in the April issue of this journal.) This newly developed device was granted the Second Prize in the spring BNV competition of the KGM [Ministry of Metallurgy and Machine Manufacture].

The now exhibited members of the TERTA data teleprocessing product family will contribute to the more widespread use of data teleprocessing systems in a more effective manner.

The SZKI exhibited in two locations. In Exhibit Hall A, it showed the MO5X microcomputer family. Micromputers play an important role in geophysical instruments, medical devices, traffic control systems, data teleprocessing systems, automation systems, machine-tool controls, data preparation, and manufacturing operations. Their use is not only modern but also very economical. The devices were shown in operation, and demonstrated clearly the methods of automated programming of the special solid-state memory units. They also showed in detail the potentialities offered by the simulation system for program control. By making use of the latter feature, the programming functions of the microcomputer can be performed at a significantly higher speed.

Within the exhibit of the OMFB [National Technical Development Committee], the SZKI, in cooperation with 15 domestic computer-technological manufacturers, users, developers, and administrators, demonstrated in a professionally coordinated manner the way in which computer technology may be used in some selected areas of the national economy, and displayed the devices and programs it has developed for these purposes. The aim of this display was to show the following: the manner in which the computer-technological developing, using, and manufacturing base is equipped to contribute to the solution of the major tasks specified in the Fifth Five-Year Plan. It also illustrated the achievements of domestic computer technology during the Course of the Fourth Five-Year Plan, as a result of which it became possible to offer assistance to the national economy in meeting some of its important goals. The following were included in the exhibit: the role of computer technology in exploiting, transporting, and managing supplies of energy and raw materials, management of materials and stocks, improving the efficiency of enterprise management and administration, development of modern decision-making systems, health matters, product development, and quality control.

In the transportation sector, the SZAMLAK [expansion unknown], established jointly by the SZKI [Computer Technology Research Institute] and SZAMKI [expansion unknown], concluded an agreement with the MAV [Hungarian State Railways] for the computerized direction of railway traffic. They developed jointly the microcomputer-based information system of medium-size hump yards, which was the basis of all further control systems. The system developed for the hump yards was exhibited, and after successful termination of its trials will be installed in approximately 15 similarly sized hump yards.

Insofar as applications in the health sector are concerned, mention must be made of the diagnostic and laboratory measurement system developed jointly with MEDICOR enterprise. This system was awarded the Grand Prize of the BNV. This measuring system is a member of a family developed by MEDICOR. In its various versions, it ensures high-level instrumentation for the regional physicians and meets the needs of high-level central laboratories (and performs everything in between). With the aid of the MEDIPRINT system, which may be connected to the diagnostic box, data about the patient and his past medical history may be stored, together with the results of the tests and examinations. The MEDIPRINT may also be operated independently, for example in regional hospitals and it may also be used in conjunction with a computer, for example in central hospitals.

Another medical application was shown at the stand of the Telecommunications Research Institute, where the EKG [electro-cardiogram] diagnostic station was exhibited, based on the R-10. The device was developed in cooperation with the National Institute of Cardiology; its basic principle is that the computer recognizes shapes and on this basis evaluates the EKG signals. The results of the evaluation are reported to the physician by the system, who may then refine the diagnosis. The system also performs the required administrative functions (patient identification, medical past history, and so forth). If the teleprocessing mode is employed, up to 16 instruments may be connected to one computer.

MOM [Hungarian Optical Works] exhibited the MINIFLEX (MF 3200) floppy disk storage unit, which is a novel means for information recording, storing, and retrieval. This apparatus was honored by the Fair Prize of the BNV. The information is carried on a plastic-encased flexible plastic disk. Its capacity is several times higher than that of several dozens of magnetic tapes or 2000 perforated cards. It is relatively inexpensive, and may be used in a versatile manner. The device may be used primarily for the following purposes: storage of programs; entry of microprogram commands as an integrated computer peripheral device; generation of microprograms; external memory; part of intelligent terminals in conjunction with monitor and microprocessor; data collection, recording, and preparation to replace perforated tape and punched cards.

The ORGTEKSZT text processing and organizing automaton, using MOM perforated tape peripheral devices, was developed jointly with the VNIORGTEKHNIKA [expansion unknown]. Among others, this device can perform the following: recording of alpha-numeric information, reproduction of such information, correcting the information in a semi-automated and programmed manner, and automation of the compilation of various textual and tabular reports used in state bureaus and AIR [expansion unknown] computer centers. The components of the automaton are the six following units, all with unified interface: central processor, data input/output device based on an electric typewriter, perforated-tape reader with winder (Type ERS 42), two tape perforators (Type EP 32), and perforated tape reader (Type ER 42).

The VILATI [Electrical Industry Scientific Association] exhibited the already known PRACTICOMP, PREPAMAT, PREPALINE, and FLOPPYMAT-D data recording units. Of the latter, which is a new development, the data carrier is a floppy disk with a useful information capacity of 242,944 bytes. The data are recorded on the disk in 74 tracks, with 26 sectors per track. The capacity of a sector (physical record length) is 128 eight-bit characters.

There is random access to the individual sectors. The data entered through the alpha-numeric keyboard may be checked before final entry on the monitor screen. The already recorded data may be called up, and each character of the information content may be modified.

The Metal-Processing Cooperative exhibited devices suitable for the storage of magnetic tape and punched cards. In 1968, this cooperative purchased a licence (from the West-German Zippel company) for the manufacture of various cardboard containers. The containers for use in computer centers are developed on the basis of these units. At the present time, the manufacturing line includes Regal and Kompress type storage cabinets and various automatic storage devices. The latter are made of steel sheet; they are self-supporting, and the shelves move along vertical and circular tracks with the aid of an electric actuator drive (the paternoster [elevator] principle). The fireproof steel sheet cabinet is locked by a door equipped with a safety lock, so that protection from dust and unauthorized opening is provided. External magnetic fields are also excluded. When the sliding door is closed, a switch shuts down the entire system. The computer-technology automata are manually or automatically controlled. In the case of automatic control, the storey selector knob is used to set the desired storey, and the device may be started. The automatic system of the storage units ensures that the desired storey is reached over the shortest way (from above or from below) to the control console. In the case of manual control, the appropriate button must be kept depressed until the desired storey plane reaches the level of the console. The button is then released and the device stops at the console level. In the case of manual control, the storeys always move in the same direction. In the exhibited 870 LD perforated-card storage unit, eight boxes may be stored per storey, a total of 320 boxes; in the 870 M magnetic-tape storage unit, 40 tapes may be stored per storey, a total of 560 magnetic tapes.

The preparation cart is suitable for the in-house transportation of magnetic tapes and stacks of magnetic disks. In smaller facilities it may also be used for storage. Its capacity is 6 stacks of magnetic disks or 15 magnetic tape reels.

Among the computer-technological novelties from the Soviet Union the BNV exhibit showed, among others, the ESZ 1033 computer model, the M-7000 computer system, and the ESZ 7052 plotter.

The ESZ 1033 is the latest, medium-size member of the ESZR family; it has a capacity of 256-512 kbytes. This is the first ESZ device containing circuits of medium-level integration; thus, it qualifies as a third-generation device. According to the plans, the fourth-generation computers will be developed on the basis of this device in the Soviet Union. Both the processor and the multiplexer channel are microprogram-controlled; their



checking is accomplished with the aid of individual built-in microprograms. It differs from the ESZ 1030 in the following, among others: it has a higher command-execution and data-access speed, and the multiplexer channel and data protection facilities are based on the Soviet-made 155RU2 integrated circuit. The representatives of the ELEKTRONORGTEKHNIKA explained that the ESZR 1 program is completed, and the next step is the start of the manufacture of the devices of the ESZR 2 series. This has already begun in the Soviet Union: the state approval of the R-60 has been granted, and the state approval of the R-45 is expected for the summer of this year. State approval of the R-35 is expected in 1977.

The M-7000 computer, designed for use in automated control systems, is a developed version of the M-6000. The memory capacity is now up to 128 kbytes (compared to 32 kbytes for the M-6000). The various computer systems capable of being assembled from the units and modules of the M-7000 may be used, among others, for the following tasks in industry: acquisition and primary processing of information collected from complex control systems, central control of manufacturing processes, control of real-time technological processes, solution of engineering and scientific tasks, functions of the data-processing center in time-sharing systems, control of machine tools, and organization of the background memory system of large-size data-processing centers.

The exhibit of METRONEX (Poland) featured the MERA 305 minicomputer, the PT 105-1 slow-step magnetic tape memory unit, and the PK-1 cassette unit. The MERA 305 is a versatile minicomputer; it may be used with success primarily in the following fields: warehouse management, billing, accounting, wage calculations, and shipping. Its memory has a capacity of 8 kbytes; it has a programmed channel, a multiplex channel, and the control unit for the MERA 9425 magnetic disk unit. The following peripheral equipment is available: DZM 180-line mosaic printer, DTK 50 R tape and card puncher, and up to four MERA 9425 magnetic disk units (the latter built on the basis of a CDC licence).

The PT 105-1 magnetic tape memory unit may be used in off-line and on-line operation. It may be used to read magnetic tape on which the data had been recorded according to the IBM standard, using the NRZI data-recording method at a character density of 8 lines/mm or 32 lines/mm. The following are its most important parameters: data transmission rate, up to 16 KB/sec; data-recording method, NRZI; tape speed, 0.5 m/sec; tape movement, single roll; magnetic head, read-after-write with two-gap ferrite head.

The basic function of the PK-1 cassette memory is to record digital information on magnetic tape and read it back at any desired time. The information is recorded on magnetic tape accommodated in the COMPACT cassette, of

which the parameters correspond to those of the ECMA-34 and ISO/TC97/SC11 standards. The PK-1 cassette memory may be used in many fields of informatics because it has a large capacity. It may be especially useful in data preparation and processing. In such systems, the PK-1 may also be used as an input and output peripheral system and as an external memory for voucher-preparing systems, office calculators, and cash registers. It may also be used in controls for numerically guided machine tools and for the control of technological processes as well as in testing systems.

The Buromaschinen-Export enterprise in East Germany exhibited the DARO 1840 office computer, the DARO 1154 printer, and the ROBOTRON 4200 computer. The DARO 1154 line printer is a pin-type matrix printer. It may be used in data acquisition and data processing systems. The ROBOTRON 4200 has a high-speed ferrite-core memory with a capacity of 4096, 8192, or 16,384 words. Each word has a length of 16 bits. Entry and output of the data, and the organization of the central memory and the subprograms, as well as debugging is performed by the machine itself.

The computer-technology exhibit of Bulgaria featured the products of ISO-TIMPEX. The following units were shown: the latest duplicating machines, office equipment, various automation systems, some miniperipheral units (minidisk and minitape recorders), pocket calculators, and the ESZ 9002 magnetic tape unit. The latter is designed for transferring directly the data from the keyboard to the tape, the checking of the data, and the retrieval of the stored data. Automatic and noiseless operation, programmed checking, character display, and so forth all are features which make the ESZ9002 more than 40 percent more effective than large tape punchers.

The new device exhibited by HEWLETT-PACKARD on the BNV was the 9830/A table-top computer, of which the use is very varied (it may be used for engineering computations, medical diagnostic operations, and so forth). Its read-write memory has a capacity of 4 kbytes, which may be expanded to 16 kbytes. It also has a BASIC compiler, which means an additional 16 kbyte capacity, as well as a ROM [Read-Only Memory]. If all units are used at the same time, the capacity increases to 40 kbytes. Supplementation of the memory with a built-in cassette increases the capacity with another 64 kbytes. The programs and the data may be entered in the memory through cassette or keyboard. The 32-character LED [light-emitting diode] display shows the alpha-numeric data during programming or program running.

This year's IBM exhibit featured the 3790 communication system (some components), the 3277 IBM screen terminal, the 3767 IBM matrix printer terminal,

and some text-processing units. At the fair, the IBM 3790 terminal family was seen in off-line operation, and the IBM 3767 matrix-printer terminals were seen in on-line operation in combination with the 370/145 computer of IMB Magyarorszagikft [IBM Hungary Limited]. The exhibits demonstrated automobile insurance, spare-part dispatching, and the APL/CMS programming language.

Among the typewriters, one of the latest model is the MC 82 magnetic-card unit, which consists of a selectric typewriter, magnetic card unit, and a 8000 position memory. The latter is the core piece of the system, which processes and organizes the text portions and variable data until the final form is reached. The texts written by the typist or read from the magnetic card are electronically recorded and any desired corrections are performed. The typewriter is equipped with a special correction feature which, when the appropriate key is depressed, corrects the typographic error in the memory and on the paper. The machine also performs other work automatically (such as centering, underscoring, tabulation).

The Western exhibitors — same as last year — did not bring large systems to Budapest since their sale becomes less and less likely as the ESZR program unfolds. They restricted their exhibits to relatively small computers, peripheral units, and auxiliary devices.

2542

CSO: 2502

## HUNGARY

### INSTITUTES COOPERATE TO DEVELOP LSI TECHNOLOGY

Budapest NEPSZABADSAG in Hungarian 7 Oct 77 p 5

[Excerpts] At the initiative of Pal Lenard, academician and managing director of the Central Physics Research Institute, two industrial and two academy research institutes formed an association to coordinate research and development in the field of LSI's in 1975. The institutes involved are the Central Physics Research Institute, the Technical Physics Research Institute of the Academy, the Telecommunications Research Institute and the Communications Technology Research Institute. The United Incandescent Factory signed the agreement as "supporting member" of the association since it will be the principal beneficiary of the results of the research and development. It is the specific goal of the association to evolve a basic technology for production of silicon substrate LSI's. Although this is no trivial task, it seems solvable through the unification of the intellectual and technical capacities of the four institutes. The aim of the venture is to have an LSI pilot plant in operation at the Communications Technology Research Institute by 1980.

The research and development association was formed in June 1976 after a year's preparatory work. It had the full support of the highest authorities involved: the National Technical Development Committee, the Ministry of Metallurgy and Machine Industry and Hungarian Academy of Sciences. The association is headed by a supervisory committee, while operational affairs are in the hands of the scientific-technical council. This latter meets monthly at the Telecommunications Research Institute where its sessions frequently extend far into the night as it debates the joint agenda. A group composed of members from each of the four institutes is assigned to the individual problems. The assignments are made on the basis of expediency.

Although it may be too soon to make a final judgment after a year, experiences to date seem encouraging. There is harmony between the previously competing institutes and at all levels of leadership. The party organization of all four institutes is also working to support solution of the task.

The objective is to attain a degree of organization insofar as materials and parts are concerned which will lay the foundation for extensive use and further development by 1980. This work involves not only inspection of the silicon and the impurities which must be added to it but also monitoring of the purity of the imported basic materials, establishment of the special laboratories needed for processing. One step, the complex operation of ion implantation, could not be taken without the nuclear physics equipment of the Central Physics Research Institute.

Design of the geometry of the forms and of the layers which affect the function of the LSI devices is of decisive importance. This design task cannot be performed without the aid of computers and the machine planning systems realized on them. This work is being done by the Telecommunications Research Institute. Another difficult task is the final testing of the end products. This is to be done by a special computer-operated verifying system developed by the Communications Technology Research Industry.

CSO: 2502

## HUNGARY

### BRIEFS

INFECTED POTATOES--According to Dr Istvan Sarvari, head of the department of potato research at the Keszthely University of Agriculture, the department has spent the past 23 years cultivating wild potatoes in order to breed strains which are immune to virus. The research was necessitated by the fact that 90 percent of Hungary's seed potatoes are infected. This, he believes is due to excessive use of plant protective agents: the agents have destroyed the natural enemies of plant lice, which spread the virus, almost completely. Hitherto unknown techniques were used in developing the resistant potatoes. Such techniques will also be needed when the new seed potatoes are propagated. The new potatoes, pink outside and white inside, have a far higher protein content than their predecessors. "We have developed new seed potatoes. Our results are already known to foreign specialist who show great interest in them," said Dr Sarvari. The domesticated plants are now being investigated by the National Agricultural Variety Research Institute. If all goes well, propagation will begin. Then there will be enough good looking and tasting potatoes in the markets by the early 1980's. [Budapest ESTI HIRLAP in Hungarian 10 Oct 77 p 3]

CSO: 2502

ROMANIA

CHEMICAL INDUSTRY MINISTER DISCUSSES POLYMER DEVELOPMENT

Bucharest STIINTA SI TEHNICA in Romanian No 7, Jul 77 pp 10-11

[Interview with Eng Mihail Florescu, minister of the chemical industry, by Petre Junie]

[Text] [Question] Mr Minister, in the past issue of our magazine you referred to the structure and qualitative changes of our current production of plastics. Could you now describe for our readers the main groups of synthetic polymers which are important in the production of plastic materials?

[Answer] One of the great discoveries of macromolecular chemistry was that of thermoplastic polymers. Among these, polyvinyl chloride underwent a rapid development until the appearance of polyolefins, which proved to have a broader use; these in turn, resulted in an even more rapid growth rate.

At the end of the 1960 decade, the order of these materials reversed, and polyolefin use was greater than that of polyvinyl chloride and its copolymers, followed by polystyrene and its copolymers.

The rapid development of polypropylene in recent years has caused the olefin group to advance substantially ahead of other products in the same category.

In 1980, 20 percent of Romania's total production of plastics and synthetic resins will be devoted to low density polyethylene. The average rate of annual production growth will be 18.8 percent, as compared to 14.8 percent for the world average.

Low density polyethylene is obtained through the polymerization of ethylene at high pressure (2000 or more atmospheres), is more flexible than the other polyolefins (low pressure polyethylene and polypropylene), and is processed more readily by means of different techniques.

This polymer is used especially in the form of films, sacks, and bags for packaging fertilizer, chemical and food products, and textiles, as well as

for the protection of constructions, greenhouses, and agricultural crops. Some of its other uses are as insulators for electric cables and conductors, as tubing and conduits for water and other liquids, for reservoirs, tanks, medical products, and toys.

At an average rate of development of more than 35 percent per year, the proportion of high density polyethylene products in Romania's total production of plastics will go from 7 percent in 1975, to 20.7 percent in 1980.

The worldwide consumption of high density polyethylene will increase by 13-15 percent, achieving the second highest rate of development among large tonnage polymers as a result of the product's favorable balance of energy consumption, cost, and characteristics. It is expected that up to 25 percent of the production of low density polyethylene will be replaced in future years with high density polyethylene.

The structure of high density polyethylene is more regular and much more crystalline as a result of polymerization with stereospecific catalysts. For this reason, it is more rigid than low density polyethylene and more resistant to temperature, mechanical, and chemical stress. It is used primarily in the form of dense or porous sheets, as shaped articles for constructions, construction equipment, electrical instruments, electronic devices, plumbing items, containers, films, tubes, toys, and packaging.

[Question] The research to diversify the production of polyolefins has introduced a new plastic material, polypropylene. What is the prognosis for this material throughout the world and in our country?

[Answer] Between 1977 and 1980, polypropylene will be developed at an average rate of 16 percent per year, and will occupy an important place in the production of processed plastic products in Romania in 1980. Throughout the world, the production is expected to increase at a rate of 12-20 percent per year. It is estimated that because its energy consumption is 30 percent lower than that required to obtain and process high density polyethylene, polypropylene will replace about 25-30 percent of the latter by 1980. It is also expected that it will supplant 10-15 percent of the shock absorbing polystyrene and polyvinyl chloride usage.

The polypropylene obtained by polymerizing propylene in the presence of stereospecific catalysts, is a rigid and crystalline polymer which has become one of the currently used products as a result of its profitable fabrication and superior characteristics. Its production and processing requires low energy consumption, and propylene is relatively inexpensive, being obtained concurrently with ethylene in the pyrolysis process. Ethylene-propylene copolymers are also obtained together with small quantities of ethylene. And material properties can be diversified by using mixtures of different proportions with other polyolefins.



Polypropylene is preferred for its temperature and mechanical resistance, as well as for its dielectric properties. Its principal applications are in the automotive industry, in the manufacture of household and technical products, containers, boxes, framing, sterilizable medical articles, films, tanks, packaging, and in weaving bags (similar to those made of jute) from drawn polypropylene fibers and natural fibers. Polypropylene films are used primarily as packaging for food products.

[Question] At one time, polyvinyl chloride -- the well-known PVC -- defined an era in the production of thermoplastic materials. But now its production is declining. Can the career of PVC be considered to be ending?

[Answer] In 1974, the proportion of this polymer in the consumption of manufactured goods in industrially developed nations was 22-31 percent, a figure which will drop by several percentage points even though its consumption is expected to grow by 8-9 percent per year. Assuming that technical solutions can be found to health protection problems, and since the production of PVC is competitive from an energy standpoint, it is expected that by 1980 the consumption of PVC will be twice as high as in 1972, resulting from its substitution for copper, cast iron, asbestos cement, and other materials. However, the experiences of 1975 have created a certain elasticity in the demand for PVC, raising the fear that the level of demand will be affected by 10-15 percent if higher price increases occur.

The properties of PVC can be improved by combining vinylic polymers and copolymers with various additives, to obtain a very wide range of rigid or flexible products with different properties or applications.

The essential characteristics of rigid vinyl polymers are their resistance to corrosion, thermal and electrical insulation, non-flamability, resistance to atmospheric agents, ease of coloring, and good transparency. These define their major applications: construction materials, electrical insulation for cables and wires, sheets and films for packaging, accessories and parts, instruments and machinery, tanks and containers. Plastified vinylic polymers are also widely used as flexible, malleable sheets (in the manufacture of floor coverings, to cover agricultural soils, for waterproofing canals in agriculture, to upholster automobiles and furniture, for clothing), or to make simple or textile-supported carpets, floor tiles, artificial leather goods, and so on.

[Question] Some of the currently widely used plastic materials are styrene polymers and copolymers. What will be the evolution of this category of plastics, given their important applications in industrial areas?

[Answer] The proportion of products manufactured from polystyrene and its copolymers in the total Romanian production of plastic products will grow from 4 percent in 1975, to 3.6 percent [sic] in 1980, at an average annual rate of development of 17.4 percent. The average rate of growth of the world's production is estimated to be 11.4 percent. Anticipating that

western European consumption in 1980 will be twice that of 1974, and considering the growth rates indicated above, processed styrene polymers are expected to fall in the category of high tonnage polymers. Their proportion should reach 20 percent of the total production of polymers. The production of polystyrene and its copolymers in developed nations is structured as follows: 57 percent standard and shock absorbing polystyrene, 13.5 percent expandable polystyrene, 12 percent styrene-butadiene copolymers, 8 percent acrylic-butadiene-styrene copolymers (ABS), 7 percent polystyrene resins, and 2.5 percent other varieties. The major consumers of polystyrene are packaging and household users, particularly for electrical appliances. Polystyrene, which is obtained from the polymerization of styrene, is rigid, has good resistance, is easily processed, but is dissolved by organic solvents. Shock resistant polystyrene is obtained by mixing with different elastomers, and ABS copolymers by blending with the butadienestyrene rubber of acrylonitrile styrene. The major branches which use ABS are the automotive sector (30 percent), electrical appliances (25 percent), packaging (6-7 percent), and telephones (5 percent).

[Question] Given the time since their discovery and application, thermorigid plastic materials are considered to belong to the category of classic polymers. What is their role today, and what are the expectations for their future?

[Answer] Although the chronological appearance of plastics is placed after World War I, the first attempts to obtain thermorigid materials were made much earlier: nitrocellulose in 1862, celluloid in 1870, Bakelite in 1872, urea formaldehyde resins in 1918, methyl polymethacrylate in 1929-1931, and Melamine in 1934.

And although the production of thermorigid plastics has continued to increase at a rather rapid rate once the polymerization mechanism which led to the proliferation of thermoplastic polymers became understood, their applications are still behind those of thermoplastics.

On a world-wide scale, the production of a broad range of thermorigid plastics is estimated to increase at an average annual rate of 9.9 percent by 1980, compared to the production of thermoplastics, whose rate will be 13.8 percent.

The principal thermorigid plastics being produced today in Romania are celluloid, aminoplastics, phenoplastics, methyl polymethacrylate, ureo-formaldehydes, unsaturated polyesters, and polyurethanes; by 1980, we will add frigofen, polyacrylamide, polycarbonate, and Melamine.

In Romania as well, the growth rate of thermorigid plastics during the 1970-1980 period (3.5 times) will be lower than that of thermoplastics (5.7 times).

The proportion of polyurethane processed products in Romania will increase at an average rate of 16 percent per year. According to the new forecasts, the production of polyurethane in future years will be one of the most

lucrative; in the developed nations it will grow at a rate of 10-15 percent per year, which implies that production capabilities will be doubled.

Polyurethanes are used in many different products because of the variable properties which can be obtained by modifying their chemical structures. Their major use is as flexible or rigid foams in manufacturing sandwich structures for constructions, furniture, automobiles, clothing, technical equipment, and so on.

Polyurethane polymers also represent one of the most useful elastomer material available. In addition to the large variety of methods which can be used to process them, their advantages over other elastomers derive from their resistance to adhesives, oils, and solvents, their tensile strength, their flexibility and elasticity over a broad domain, and their greater resistance to aging in the presence of oxygen.

The production of unsaturated polyesters in Romania will increase at a rate of 82 percent, and in 1980, they will amount to 0.2 percent of the total production. The average rate of development of this production throughout the world is estimated at about 25 percent, and its proportion in the total production at 3.2 percent.

Unsaturated polyesters reinforced with glass fibers are processed in various ways into sheets, mobile constructions, pipes, parts for equipment and instruments, chemical industry equipment, boats, automotive bodies, aircraft parts, shipbuilding materials, railway equipment, mining devices, and so on.

The proportion of technologic polymers (polyamide, polymethyl methacrylate, polycarbonate, and so on) will increase at an average rate of 16 percent per year as new capabilities are being built. The average rates of growth of technologic polymer production in industrialized countries have been estimated at 11-30 percent per year, depending on the polymer.

[Question] The increasing demand, and the particular, specific properties required by various domains of application of plastic materials, have resulted in the appearance of the so-called low tonnage polymers. Could you comment on the present stage and future expectations for these materials?

[Answer] This group includes a number of polymers and copolymers whose processing and use are rather limited in Romania and throughout the world, but whose production tends to grow due to their special properties which compete with metals in the construction of technical equipment and special packaging (good resistance to temperatures above 200 °C, outstanding mechanical resistance, transparency, non-flamability, ability to be sterilized, low water absorption, good dimensional stability, chemical resistance, and so on). The major types of such plastic materials are the fluorinated polymers and copolymers, polymethyl-4-pentane-1, transparent polyamides, polyphenylene sulfide, polysulfonyls, polyacrylsulfonyls, polytersulfonyls, polyalkylene terephthalate, polyamides, polyphenyl oxide, and polyacetals.

It is estimated that these special types of polymers will attain a very large diversity, and that the world production will reach some 400,000 tons in 1980.

In Romania, low tonnage polymers came into being with the construction of the first installations for bulk polymerized caprolactame. The current five-year plan will see the construction of the first installations for fluorinated polymers, polycarbonates, and some types of polyethylenes with specific properties.

Research in this domain will seek to achieve a broad range of products which will cover the application needs in the most diversified domains.

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END